An Overview of Belt Air Issues and NIOSH Belt Entry-related Research

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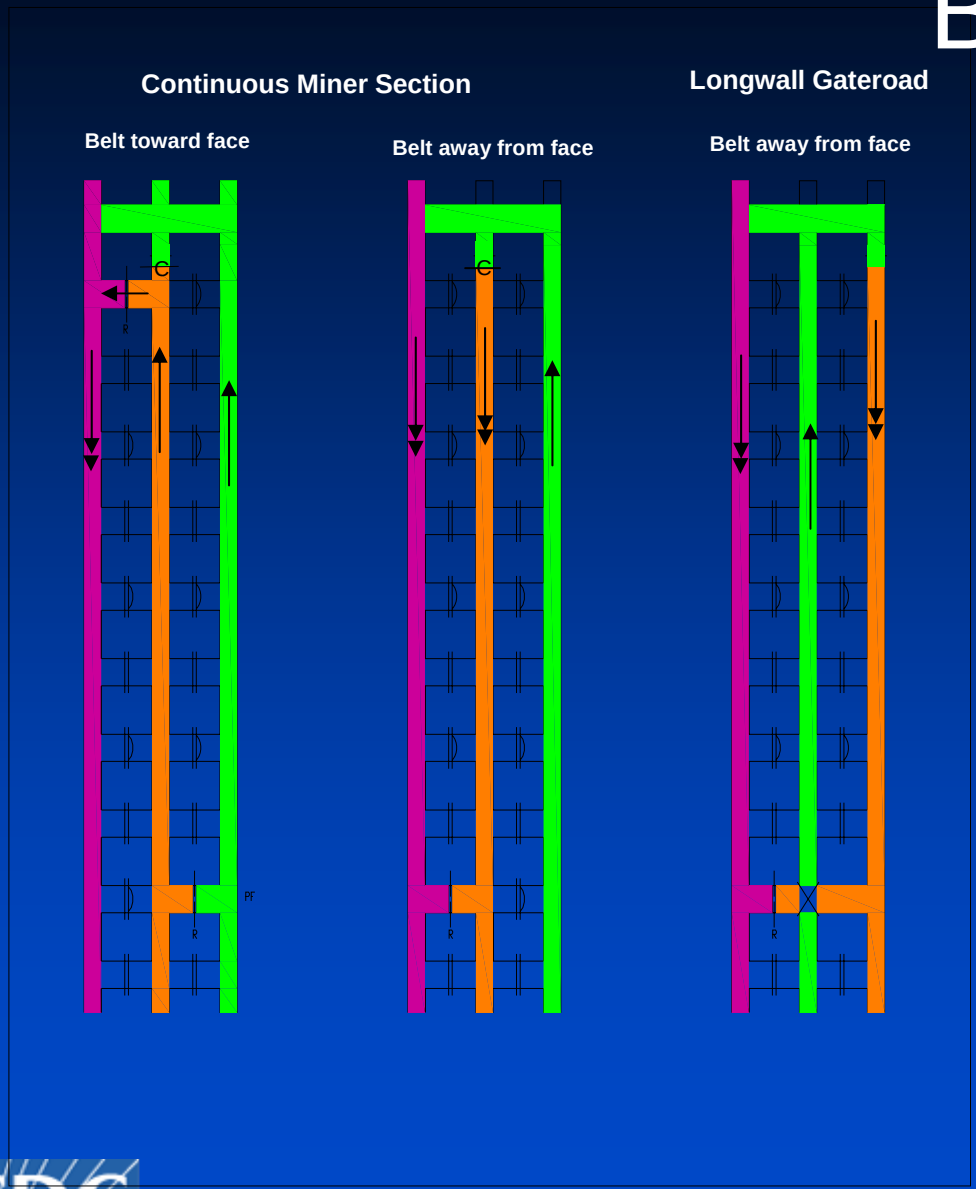
Today's Presentation

- Why use belt air?
- What are the risks of using belt air?
- How are these risks managed?
- How does the research inform the decision?
- What are some focus areas for deliberation?

Belt Air on Return



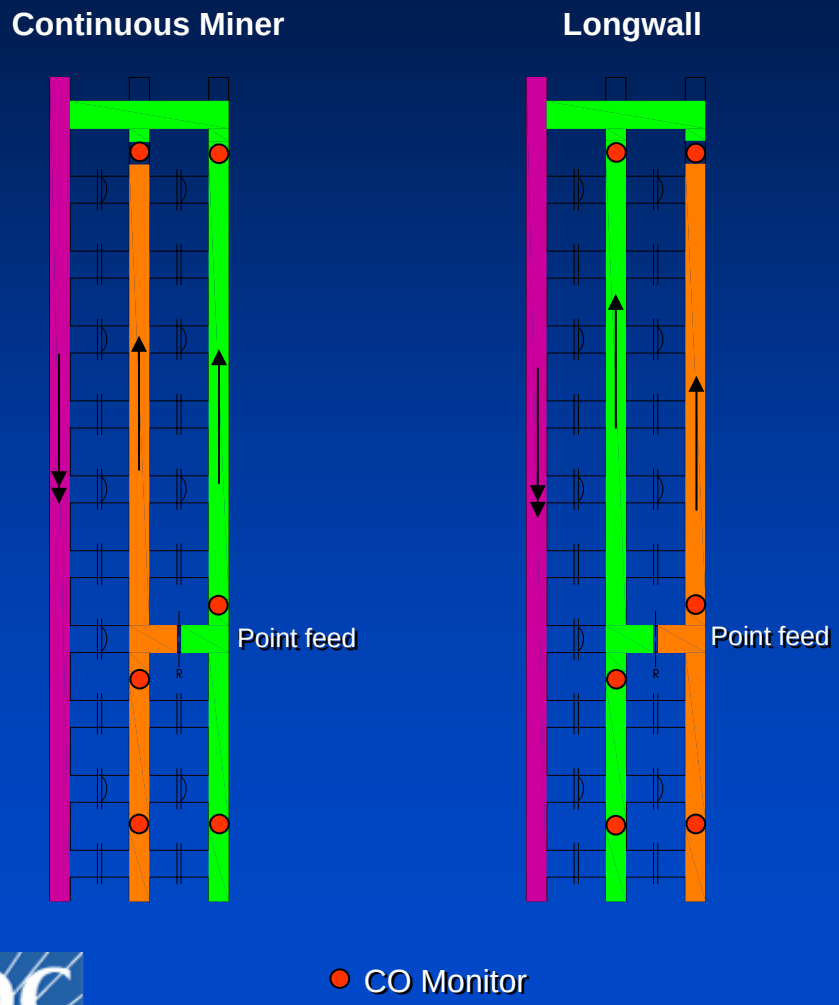
Cited Advantages

- Dust & gas coursed to return
- Smoke from a fire doesn't flood the face (not entirely true)

Cited Disadvantages

- unable to move sufficient air to the face, in some mines, without the use of belt air on intake
- Lack of protection associated with 75 CFR 350

Belt Air on Intake



Cited Advantages

- Improved ventilation under difficult conditions
- Early detection of fire
- Water line/airflow in same direction
- 30CFR 75.350 safeguards

Cited Disadvantages

- Potential for increased dust & gas at the working face
- Flood the face with smoke if there is a fire in the belt entry

Why Use “Belt Air” ?

- Need for additional air quantity
  - Methane control
- Inability to deliver additional air through existing aircourses
  - Pressure limitations relative to adjacent entries
  - Practical limitations on power
- Inability to deliver additional air by adding another entry or by increasing entry width
  - Ground control limitations

Entry Restrictions Relative to Ground Control

- Stress level (Pressure Arch Theory)
  - Direct function of panel width and number of entries
  - Extreme conditions require minimizing stress
    - Deep cover
    - Bump-prone strata
    - Weak roof or floor

Entry Restrictions Relative to Ground Control

- Intersections
  - Roof failures eight-times more likely than straight entries
  - Two-entry developments contain 33% fewer intersections than 3-entry, 50% fewer than 4-entry

Concerns arising from coursing intake air over the belt

- Conveyor-belt system subject to problems that can ignite fires, e.g. idler bearing failures, belt tracking, belt slippage, etc.
- Coal spillage and accumulation problems
- Conveyor belt flammability
- Dust entrainment
- Methane

Belt-use Risk Surveys

Period	1970 -1990 (USBM)	1980-2005 (MSHA)
Fires	56	62
Percent of Total Fires	28	15-20
Fatalities	0	1

What are the risks?

- Increased respirable dust concentration at the face
- Increased methane at the face
- Increased density of smoke at the face if there is a fire in the belt (hindering escape)
- Increased density of smoke in the intake escapeway due to pressure imbalance (hindering escape)
- Increased smoke load based on belt flammability

How are these risks addressed?

- Keep average respirable dust concentration at or below 1.0 mg/m^3 (30CFR 75.350)
- Provide early detection and warning of fire
  - AMS (30CFR 75.350)
    - Sensors in Intake (primary escapeway), Belt, and at Point-feed
- Reduce likelihood of smoke flooding the intake escapeway (30CFR 75.350)
  - No more than 50% of total intake air can be supplied from belt
  - Point-feed
    - Remote closing
    - 300 ft/min min velocity thru regulator
    - Upstream air in belt and intake monitored for CO and smoke
- Require minimum of three entries (30CFR 75.350)
- Use directional lifelines (30CFR 75.380)

Effect of Fires on Ventilation

- Ventilated entry permits byproducts to flow more rapidly throughout mine
- Reduces air movement within entry
- Potential secondary problems of reduced airflow:
  - Methane accumulation
  - Inadequate oxygen
  - Flow into adjoining entries
  - Escape difficulties

Effect of Fires on Ventilation (continued)

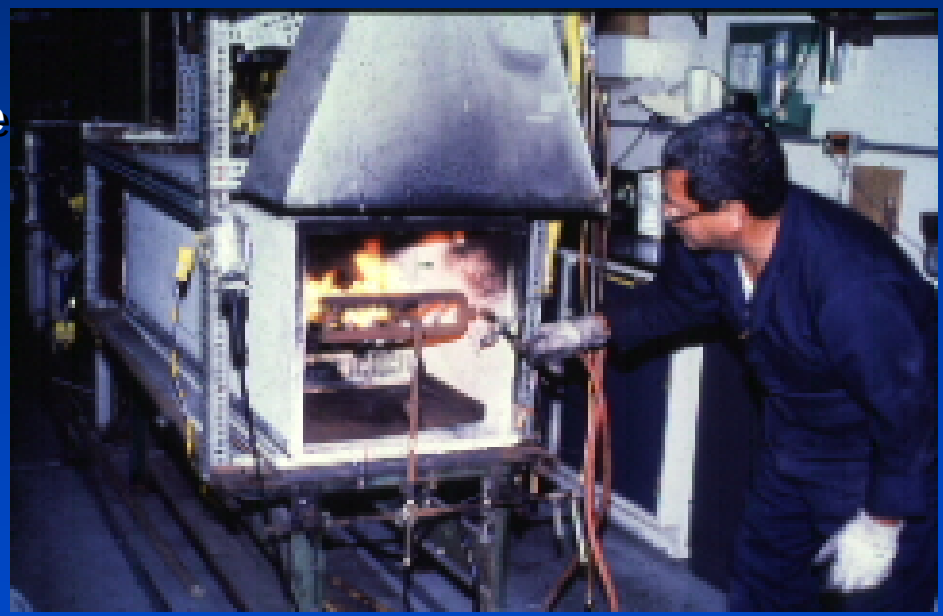
- Smoke will migrate to face regardless the air flow direction
- Belts on return air
  - Fires can be larger and more deadly
    - Additional level of protection afforded by 30CFR 75.350 not required

Atmospheric Monitoring System

- Mature technology
- 157 Mines presently using AMS
- Tested and calibrated every 31 days
- Automatic visual and audible alert signals
  - Surface
- Automatic visual and audible alarm signals
  - Surface
  - Working sections
  - Affected areas
  - Other locations specified in Mine Emergency Evacuation and Firefighting Program of Instruction
- Automatic visual and audible signal when two consecutive sensors alert
  - Surface
  - Working sections
  - Affected areas

USBM/NIOSH Related Research

- Ground Control
- Belt Flammability
  - Conveyor Belt Flammability Studies
  - Testing of Fire-resistant Conveyor Belting
- Toxicity
  - Primary Gas Toxicities and Smoke Particle Characteristics During a Two-stage Combustion of Mine Conveyor Belts
- Ventilation
  - Calculating Fire-throttling of Mine Ventilation Airflow
- Dust Control
  - Dust Concentrations When Using Belt Entry Air to Ventilate Work Areas



CDC Workplace Safety and Health

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Presentation Topics

- Belt Flammability - Charles P. Lazzara, Ph.D.
- Belt Toxicity - C. David Litton
- Ventilation - Robert B. Krog
- Escape - Fred N. Kissell, Ph.D.
- Ground Control
- Dust
- Sensors

Possible Focus Issues

- Flammability of belts
  - Changes over the years in belt makeup
  - Tradeoffs in belt materials
  - Adequacy of other measures
- Air velocity cap
  - Efficacy of fire suppression systems at higher velocities
  - Adequacy of pressure balance and sensor placement guidance, if no limit on velocity